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The American Biology Teacher

VOL. 4 OCTOBER, 1941 NO. 1

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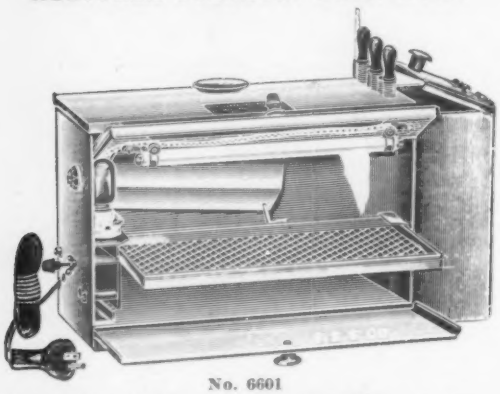

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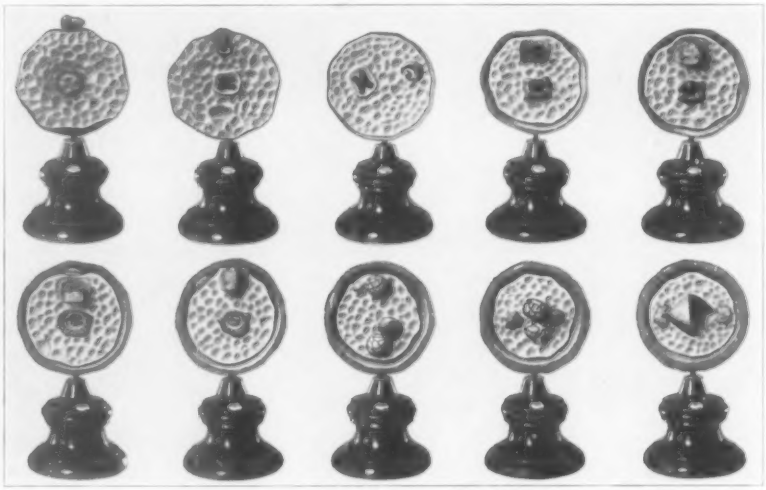

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The American Biology Teacher

Vol. 4 OCTOBER, 1941 No. 1

Biological Field Trips as an Integral Part of Science Education

I. FROM THE STANDPOINT OF A COLLEGE PROFESSOR

GEORGE W. HUNTER

Claremont College, Claremont, California

I have been asked to write a short article on this topic, treating it from the standpoint of a college professor. I confess after nearly forty-five years of teaching in secondary school, college, and university that I would have preferred to have dealt with the topic from the naive point of view of the beginning secondary school student. Here indeed field work has its most definite outcomes. But if we teach life science at the more mature level, we must also remember the place of the out-of-doors, for all too often the biology laboratory has become a place for the examination of dead things. Too often the odor of formalin and alcohol has taken the place of the clean, pure smell of the out-of-doors and our courses in life science have degenerated into drawing lessons and inexpert carving matches.

Someone has said the environment is just as important as the living things in it. In some respects it is more important for the student because the environment molds and dictates what will be found there. For this reason, if for no other, ecological field trips have a very important place in any real course in life science.

In the opinion of the writer the sooner that young people are introduced to field trips the sooner the course becomes vital to the students. This means starting the course in the fall with an introductory trip. Getting first hand experience with *living* things is one of the most important things that a student can do. The laboratory soon becomes, as a result of early field trips, a definite adjunct to the out-of-doors, and student collections added to the vivarium and aquarium make the laboratory a place of real interest.

After many years of experience with field trips, the writer has come to believe certain things are very important. First and foremost, the leader should be acquainted with the field: several student assistants should be taken in advance to the area which is to be covered. If possible, this area should be near the laboratory. The writer remembers many years ago as a young student teacher paying a visit to Dr. Herbert E. Walter, then a teacher in a Chicago high school. On reaching the laboratory, he found the room empty, and when he asked one of Dr. Walter's colleagues where he might find the class, the reply was, "He is probably over there in that vacant lot across from the school." Sure enough, there Dr. Walter and his class were at work making a study of spiders, their webs and their habits. The writer went home impressed with the value of this sort of thing as an integral part of a course in biology.

Biology in the Field

A second matter to be arranged in advance is to have a mimeographed map of the region to be covered made to be put in the hands of every student making the trip. Detailed directions are not so necessary as some explanation as to what will be found in the different localities shown. In a well organized field trip student assistants who have previously become familiar with a given area are stationed at such areas and act as guides and helpers when the students arrive at that particular point. In order to spread the group, it is sometimes well to have them rotate in small groups through the different areas. A few problem questions should be issued on mimeographed sheets, each one being tied up with a definite area. In this way the trip becomes a real laboratory exercise.

The last and most important part of the field trip which tends to make it an integral part of the course is the discussion, with examples of specimens found on the trip, held in the laboratory on the day following the trip. In this way the field and the laboratory become an integrated whole, and the student sees the significance of the field work.

The suggestions made above are equally applicable in secondary or at the college level. There is, however, an additional value at the college level which is worthy of consideration. Able students may be sent into the field to make a small, but definite contribution to the knowledge of some particular locality by means of an ecological survey. It is interesting to note that Paul Houdek, the able secretary and treasurer of the National Association of Biology Teachers, when a student at Knox College made such a survey under my direction, gave his results in a paper read before the Illinois Academy of Sciences, and had his results published in their Proceedings. This sort of thing has been done by not a few students at the college level, and the results to them have been of very great significance, first because they were placed on their own in the solution of a definite problem, and secondly, because of the satisfaction found through the publication of a small article bearing on that problem. By all means, let us make field work a definite part of our life science program.

II. FROM THE VIEWPOINT OF SECONDARY SCHOOLS

PAUL B. MANN
Evander Childs High School, New York City

A field trip should extend classroom activities into first-hand, objective experiences in about the same degree that a baseball bat or a crowbar extends the potential leverage of the human arm.

If the field trip does not accomplish stimulating and vivifying results, then some phase of the activity was mismanaged or technique of the planning was overlooked. For there *is* a technique of a field trip. A good field trip should be carefully organized yet have sufficient flexibility to take immediate advantage of new opportunities suddenly appearing, without dislocating essentials and without disorderly lack of appreciation. It is doubtful if different teachers should be required to follow identical procedures.

Let us begin by asking ourselves just why we are taking the trip. It will not be a good field trip if done merely on order from the chairman or the principal, or to meet competition from other teachers. The reasons are obvious. But if, on the other hand, there is an inner urge partly because the teacher feels the dynamic quality of life surging through the subject of biology, and partly because she or he senses the unnaturalness and inadequacy of the walled-in classroom, then things are going to be different. Such a teacher realizes that the American goldfinch in undulating flight is vastly more important than its static picture on the Audubon chart in the classroom. He also realizes that a walking stick, so superbly adapted by form and color that perhaps only one out of thirty-six saw it, sets a problem in observation instead of just an academic evaluation of long legs and extreme "slenderization" as seen in the school insect collection. Similarly, the competition of plant against plant wherever the soil is moist is something that cannot be transported to the classroom. It must be studied locally. Wild creatures in their own habitat are normally uninhibited, unless alarmed. The digger wasp will continue to dig her tunnel kicking the dirt out behind her as she backs out, even though watched by forty pairs of eyes, if quietly observed from a little distance.

Little will be gained from a field trip unless the pupils have a sense of freedom and release, so that they are keyed up to seek, and, let us hope, to find. However, if this spirit of freedom goes too far, pupils will regard the trip only as a lark, and some pupil may actually be injured by other boisterous individuals. As in the classroom, a regard for order is the first essential.

So that the pleasures of anticipation as well as realization may be shared by the pupils it is well to announce the trip considerably in advance. School authorities should be consulted and the consent of parents obtained. Thus the trip will be safeguarded from the start. Whether the trip is to a stream, fields, woods, the sea shore, or to an institution, the teacher-leader should make a personal trip there first, getting necessary permissions and noting the things that pupils can and should see, also considering what possibilities there may be for special observations not possible to program. The time is limited; what are the most important matters?

Mimeographed sheets of directions and suggestions can be of great assist-

ance in interpreting phases of the trip, can provide spaces for notes and the answering of questions raised on the guide sheet or by the instructor, and can also serve as a souvenir of the trip for insertion in the biology notebooks. It is quite surprising to see how stabilizing such a question sheet can be for pupils who otherwise might go galloping around looking for a place where they could "jump the fence."

By a little planning it is quite possible that experienced pupils who have already passed the course and have been on previous field trips can accompany the class and assist individual pupils. This benefits these older pupils as well as those they help.

What sort of equipment shall one take? This depends upon the type of trip, but if living specimens are to be brought back to the classroom or laboratory, then glass jars, vials, boxes and pails are indicated. Whatever equipment is brought, student monitors will be proud to be custodians of such properties. Cheap magazines with soft, pulp paper are excellent for spreading out flowers and leaves between the pages. The teacher will do well to have one or more hand lenses for such items as insect eggs, tiny creatures, parts of flowers and the like. Student assistants can be of great help here.

If any of the pupils are experienced in photography this will be a real opportunity to take snaps of the group at work. Photographic records of such activities are stimulating additions to the department records. (The General Biological Supply House invites teachers to submit photographs of field trips for a prize competition in Turtox News.) Interesting subjects such as a bird's nest with eggs or young, a coiled snake, a big toad, or a beautiful clump of flowers, will certainly be seen. Remember that most of the cheaper cameras can take a "close-up" only if a portrait attachment is provided and the picture taken at the exactly prescribed distance, easily measured from a string cut to that length.

One or two of the best of the photographs might be reproduced in the school paper together with a write-up of the high spots of the trip. If any of the pupils are sufficiently experienced in descriptive and narrative writing this will be an excellent opportunity for them to correlate English and biology in producing such an article. The zoology classes in the Evander Childs High School each makes one visit the second term to the Reptile House in the New York Zoological Park. Here, "behind the scenes," a harmless King snake is passed about, a girl rides on the back of the 300-year-old Galapagos Island tortoise, every one sees a snake swallow a dead mouse, and dozens of other things take place. The graphic account written by a pupil, which later appears in the Evander News, has always been one of the best of announcements of this elective course to the school at large.

The direct results of exercises in observation, perception, and appreciation developed by well-organized field trips should bring new encouragement and stimulation to most of the members of the biology class. There are some by-products, also, that are likely to accrue. Through strong interests aroused by field trips it is quite possible that certain students may come to like biology so well that they decide to follow some biological profession. Two of my better zoology pupils became so vitally interested in the American Museum of Natural History, visited frequently by the class, that they eventually became staff instructors there. Another boy, not in my immediate class, is also now at the

Museum. Another young man, through similar reasons, has become the assistant to the veterinary in the New York Zoological Park. Through field trips the human relations between teacher and pupils and between pupils themselves can become warm and significant. The extreme differences between teacher and pupils tend to disappear. Previously unexplored ambitions, weaknesses, and appreciations come to the surface through talks by the teacher with various pupils en route. The new joy of discovering personalities, capacities, and mutual points of view, brings into the group a more natural atmosphere which the wise teacher will take pains to encourage in the classroom.

III. FROM THE VIEWPOINT OF ELEMENTARY SCHOOLS

GUY V. BRUCE
New Jersey State Teachers College, Newark

No stage in the period of formal education is more conducive to implementing the motto of Agassiz, "Study nature, not books," than is the elementary level. Here the teacher has exclusive charge of her group of children from nine o'clock in the morning to three in the afternoon. She can easily exempt herself from the routine of daily schedule and enjoy relative freedom to do with her children what she will.

The elementary teacher who chooses to exercise these immunities and to walk with her children may for the first time catch a glimpse of the world as it presents itself to her young boys and girls. She will discover that much of the familiar subject matter she has learned to use and to cherish lies far beyond the horizon of their experience and readiness. The windmills and tulip beds and wooden shoes of Holland would be missing. The Eskimos, Indians and pirates would not be there. Our political and military heroes would lie far beyond the horizon and so would the pyramids and mummy chambers of Egypt. These are remote. They reside in books only. Their attainment is instruction rather than education.

The children reside in a real world that they may hear, see, touch, smell and taste. The sky is above their heads. The earth, rocks and minerals are at their feet. They stand submerged in an ocean of atmosphere. There is a world of plants and animals all about them. They are engulfed in a flood of light, color and sound. An endless galaxy of forces and phenomena; fire, magnetism, electricity, the rainbow, thunder, lightning, clouds, and so forth, present themselves. This is the world of things, forces and phenomena of which the children are a part and with which they interact. We teachers call this Elementary Science and Nature Study, for the want of a more inclusive title.

The range of subject matter is as broad as the universe. The teacher and the class may be as free as the subject matter itself. It is not a required subject as a rule. It is seldom a formal part of a course of study and there is not a very definitely prescribed method of teaching it. It calls for experience teaching. It begins with simple observation in the immediate environment with which the children interact and it employs the materials at hand. Said Bailey, "It cannot be reduced to a mere system, it is too comprehensive. . . . It is not cut and dried. . . . It cannot become a part of a rigid formal system

and method. . . . Its very essence is spirit. . . . It must proceed on the personal enthusiasm of those who are least bound by the tradition of the classroom."

The spirit and enthusiasm of which Bailey speaks is of paramount importance. Without this the best conceived program would fail. This incident cited by Dr. Edward F. Bigelow, former Editor of the Department of Nature and Science in *St. Nicholas*, is pertinent. According to Dr. Bigelow, one superintendent of a large city system complained, "I don't know what is the trouble with elementary science and nature study in my schools. I introduced it two years ago. I had my teachers prepare a course of study and I assigned fifteen minutes a day regularly to it, but the children don't seem to be interested in it. I have my doubts whether it is worth while to assign even that small amount of time to it. I am puzzled." Later, in a conversation regarding other matters, the superintendent jokingly referred to a visit which some of his teachers had made to the Adirondacks. A club went up there to stay for four weeks. They came back home at the end of two, reporting that it was the dullest place they had ever seen. The puzzle was solved. The flare, the spirit, the enthusiasm, the conviction of its worth were missing. The most carefully organized program would fail without these to furnish the leavening.

The informal opportunistic approach seems more in harmony with the spirit of this children's world. But even though nature will not fit herself to a planned outline of grade and time placement, it does not mean that the work shall be without aim. Informal work, when guided by a skilled and artful teacher, is not aimless. To insure purpose and direction, she must have a framework into which all things fit. In this instance she must have a dynamic functional view of nature in which plants and animals are all actively engaged in adjusting to the problems of living. They are getting their food, building their homes, protecting themselves against their enemies, reproducing and caring for their young, and adapting to seasonal change, just as we humans are engaged in doing all these things. She must sense a kinship between us and the rest of the living world. Her view must embrace the ecological balance in which every creature has achieved a place and is now engaged in the basic activities essential to maintaining that place. She must sense a framework of common structure and common function and interdependencies of living things and non-living things. Such a framework will give direction to her thinking and purpose to her work when she meets the great galaxy of things with their infinite variations as she goes along with her children from day to day. The teacher should have in her some of the philosopher, and some of the scientist, but more of the naturalist. She must not forget that she herself was naturalist before she was either philosopher or scientist. The successful nature teacher will be actuated by the aim of the philosopher and scientist, namely, the quest of truth, but she will employ the spirit and method of the naturalist in the conduct of her classroom and field activities.

In preparation for field excursions the teacher should go out several times to the childrens once. She should be filled with the promise that resides in the trip in order to have enough enthusiasm to inspire her children and strike a responsive chord in them. The same areas should be visited repeatedly with

the children. The same subject matter may be observed and studied repeatedly on successive walks as the season advances. Each day will bring enough change to furnish daily challenge to the children once they have learned to anticipate and sense change. When the stage is reached that the children want to go back to the field to see what has happened to the caterpillar colony they observed the day before or the milkweed worms they watched in the act of feeding, or the milkweed flower upon which they have decided to maintain a daily vigilance to detect how it turns into the interesting pod of fluff they observed and experimented with last fall, and when the children, as they return to the classroom, choose to talk about it, read about it, write about it and draw pictures about it, the zenith of achievement has been attained. At this point the field study has become an indispensable and integral part not only of the elementary science work but of the total program.

This teacher will pass on to the next grade teacher a group of children who have had association with the world of nature, which is the need of every child, and the most inspiring part of his education. They may continue with their new teacher to visit the same pond and stream and woodland; the same hillside, ledge and quarry, the same tree and the same winter scene, for as the experience grows, and the insights deepen, these familiar scenes can open up new vistas and contribute new meanings that are intellectually satisfying to the expanding outlook. Said Linnaeus, as he laid his hand on a bit of moss: "Here lies sufficient material for the study of a lifetime."

Special Articles on Field Trips by Teachers in Service

FIELD TRIPS

What We Can Expect of Them. No activity that I have been able to introduce into my classes has ever approached the "interest appeal" of field trips. Never have I been able to obtain such undivided attention of a large group as when they see for the first time such things as winged ants, larvae of aquatic insects, a solitary blue heron carefully picking its way through a marsh, a pair of copulating frogs, or the banding of some birds. These experiences and many others are the property of all biology teachers and their classes regardless of location. During the first few weeks of the school year we make several excursions to collect, preserve, and store organic material for the coming year. This not only provides a definite goal for each trip, but it is more economical than purchasing the preserved forms. "It should be the business of every biology teacher to provide personally as much of the material needed for class as is at all possible."[1] Of even more importance—the student is given an idea of different environments and the subsequent change in plant and animal form. Not the least

[1] Miller and Blaydes, *Methods and Materials For Teaching Biological Sciences*, p. 90, McGraw-Hill Book Company.

important phase of these outdoor classes, is the value of informal associations that seem never to be duplicated inside. There seems to be little doubt that powers of observation are developed much more in the field than in the classroom. No matter how we try to keep our class work varied nothing can compare with a short hike to clearly demonstrate the wideness of scope of biology.

Difficulties To Be Overcome. If the previous statements are correct there would seem to be no reason for the failure of teachers to make more frequent use of this valuable teaching aid. Even the most enthusiastic "tripper" must admit there are many difficulties to be overcome. Probably the most frequent but unjustified excuse is "no place to go." This is the most common reason given by teachers in cities where the absence of a river, pond, or woods seemed to be a valid excuse for remaining in the class rooms. Any school campus, athletic field, or vacant lot will offer innumerable opportunities for outdoor study. City schools seldom use parks, greenhouses, museums, zoos, or packing plants nearly as much as is possible. In the rural areas transportation problems will be offered as excuses; these can frequently be overcome by studying the areas around the school. Class periods may interfere. The length of the periods, however, merely limit the extent of the trip—they are not valid reasons of abandoning the idea. Lack of equipment will be another excuse. This is no more justifiable than the others. I have seen many highly successful trips completed in which not a single piece of equipment was used or at the most simple items that any enterprising teacher or class could collect. Teachers frequently say, "I'm not familiar enough with the local forms to take students on trips." There is little more excuse for not knowing the typical flora and fauna than there is not knowing what is found between the covers of the text. There should be no hesitancy on the part of the teacher to admit his inability to recognize these forms that are not familiar to him. In fact, this situation makes an ideal teaching opportunity, training the student not to guess, but to use a key to determine the identity of the form and, at the same time, add another link in the ever-growing chain of the teacher's knowledge. This experience of pupil and teacher solving the mystery of the identity of plant or animal should make for a healthy condition in the class. Of course, it is the responsibility of the teacher not to have this happen too frequently.

Organization. An unorganized trip is seldom justified. Gym classes are supposed to furnish exercise and the unplanned trip soon develops into a casual stroll with little biological value. The students should be informed of the trip in advance as their dress is usually more appropriate if they know when the trip is to be taken. Ordinarily the group should be kept together, as too much time is wasted if they become scattered. Don't load everyone down with equipment; knowing what you're looking for, should eliminate much material which often proves useless. A small notebook in which brief notes are taken will help keep the class attentive and provide material for discussions near the end of the trip or in class the next day. Care must be taken to arrange the trips so they will in no way interfere with the school program. If the school program is based on one-hour periods, the time is limited compared to the amount of time available when the trips are taken

during the "double laboratory periods." It is usually desirable to make a trip of this type, at least once in advance, in order to better plan your itinerary. If the student has a few questions assigned, he will be more alert while on the trip and, as a result, will absorb additional facts. On trips of longer types, even more definite plans should be made. If possible, map out a time schedule for each student, thus making sure that the time is not wasted in wandering around.

Types of Trips

1. All-day trips to museum, zoos, laboratories, greenhouses, etc.
2. Short trips—20–30 minutes on school campus—(bird hikes, trees and shrubs identification on school campus).
3. Habitat Hikes—emphasize the characteristic plants and animals in different environments.
4. Winter Hikes—frequently neglected, but offering innumerable opportunities.[2]
5. Collection Trips—material returned, preserved, and stored for future use.

DOUGLAS SALISBURY,
Warren Township High School,
Gurnee, Illinois

TEACHING INTERRELATIONS BY MEANS OF FIELD STUDIES

Biology on the high school level should foster the development of biological concepts and attitudes based on particular needs for effective participation in our democratic social order.

Included in this viewpoint are the concepts *interrelations* and *interdependence.* This phase of biological knowledge may be interpreted to include reciprocal relationships between the members of society and various aspects of man's relationship to his biological and physical environment.

At present, it becomes increasingly evident that we are mutually dependent upon one another, and, in addition, it is equally imperative that, if we are to adequately fulfill the need of society, greater emphasis must be placed on man's relationship to his environment. Of all the various biological subjects which are presented to our students during the course of the year, few, if any, are of greater importance or deserve more thought in their selection and alignment with valid educational purposes. Despite this significance, however, few secondary biology courses include sufficient or suitable training for developing attitudes toward these scientific spheres, to the degree that they are becoming embodied into the thinking of the population as a whole. That the average individual does not, or, perhaps, will not, understand the relationships and interrelationships taking place about him is evidenced by the prevalence of multifarious forms of maladjustment. Several specific examples will be cited as representative of the situation.

We know that, annually, fires, explosions, and accidents claim thousands of victims, both plants and animals. In many instances, this destructive work is deliberate. Individuals who do not understand interrelations may be willing to destroy man's and nature's work of many years for mere personal reasons. When these events occur society suffers, plants and animals suffer, and progress so typical of our culture suffers. One of the pertinent problems of a general biological education, therefore, is to develop principles of conduct that will be more in harmony with the spirit of interrelationships and interdependence.

Of particular importance is the development of student attitudes with regard to changeable aspects of our soil resources; and the agencies which operate to produce this change. Included among

[2] "Winter Field Trips," *American Biology Teacher,* January, 1941.

these factors we find the following: erosion; temperature; pressure; and chemical change. A recognition of these factors and the way they ramify in life is as germane to the city dweller as to the rural inhabitant.

As a basis for critical thinking, brief but important factors are here presented regarding one of the above named factors; namely, erosion. Reliable data show that approximately 90 per cent. of all the land in the United States has a slope ranging from two per cent upward. Authorities have plainly indicated the significance of these data by determining that a minimum of three billion tons of soil are shifted annually in the national area to locations which are unfavorable for agricultural pursuits. Within this eroded soil are millions of tons of minerals and humus. This action is costing the American farmer several hundred million dollars each year.

Whenever possible, actual examples of these forces at work should be studied and, in addition, practical demonstrations should be conducted in the laboratory.[1] Field studies and laboratory work should supplement each other.

A goal toward which we direct the general education of students is to enable them to associate themselves with society satisfactorily. It is not enough, therefore, to teach our youth who live in one State problems which are peculiar to that State. We must teach them to understand their interdependence and interrelations to every State in the United States.

Again, individuals who have been reared in a city may not understand the problems of a farmer; the average farmer in turn, may not understand the problems of city life. We can no longer afford to sit idly by and ignore the interdependence existing between farm and city.

It is a fact that never before in our history have so many Americans toured our country. Millions of our most prosperous people are traveling in their own cars, or by means of buses, from one end of this country to the other. This means that a strange people are eating and sleeping in a strange place. To meet this demand, thousands of tourists' homes are now operating, and eating places have rapidly come into existence. What are possible negative results from this intermingling? There is a strong possibility of disseminating disease, noxious vermin, enemy insects, undesirable weeds, harmful spores and parasites.

The above-named relationships represent distinct losses, which, directly or indirectly, affect a large number of our population. In view of this situation, there is need for inclusion in the training of our boys and girls, activities which will lead to comprehension and a proper response to these conditions. Training of this type will involve adjustments to many interrelationships. From the biological point of view, these adjustments can be made, only after individuals fully understand the basic processes of living things; the physical and biological factors of our environment; the wide ramifications of interrelations; and the whole scheme of interdependence between organisms (man included) and with their environment.

The question may be asked, "Can we teach these larger concepts to our students and, if so, by what procedure?" Obviously, we never will accomplish these objectives by exclusively using dead, stained, and mounted specimens in a classroom. What, then, is a more practical way of enabling our youth to comprehend these vital life problems? The

[1] Lee R. Yothers. "Developing Concepts and Attitudes of Time and Change through Activities." *Science Education*, 24: 1–7, 1940.

strongest recommendation which can be made is that we give girls and boys every possible opportunity to observe and study living plants and animals in their normal habitat. This is made possible by including in our biology course activities, such as field work. By means of field studies, we can direct the thinking and develop the attitudes of our students in a manner which will formulate in their minds what constitutes purposeful and beneficial relationships and interrelationships. It would be difficult to overemphasize the value of a carefully planned field study, designed to teach an understanding of life functions, interrelations, interdependence, or physical and biological factors of the environment. Likewise, as a means for teaching our young people to interpret the world in which they live, and as a means for teaching them a way of reacting toward each other and their environment, it is hard to find a method which surpasses actual field work.

Many of the maladjustments between man and his environment would not exist if the type of factors which have been enumerated were better understood. An intelligent understanding and response to this phase of scientific knowledge will be accomplished when every student has had the opportunity to actually perform activities designed about these concepts and executed in the field and not in a classroom.

Lee R. Yothers,
Rahway High School,
Rahway, New Jersey.

AN ALGA COMES ALIVE

During the year every community can witness a whole series of real, dramatic, biological events. As these are investigated others will be found that are just as important and interesting. These features are not to be book assignments but actual observation of the dramas of life in the plants and animals of the community. Every effort needs to be made to make the most of them. Of course, as interest grows, books and magazines will be consulted for information from the materials recorded by others.

We can name here but a few of these dynamic adventures that should be a part of the biology calendar but these will give an idea of the length and variety of the list. Selecting from many regions are the smelt run, fish spawning, evergreen pollination, protoplasmic streaming in spiderworts, sex habits of the night crawlers, the coming of the Purple Martins, hatching of frog eggs, swarming of the Palolo worms, mosses uncapping their spore cases, seed dispersal of witch hazel, the night show of the Night Blooming Cereus and the discharge of algal gametes. An account of the last one named will be presented.

Many times during the days we had been studying about algae references had been made to their various habits. Yet, as far as the class was concerned algae were little more than a part of the textbook.

On a field trip we made notes about the sporanges on some kinds of ferns, about moss capsules and the whiffy spurts of dust from old puff balls. We gathered specimens of these as well as of some algae. One painted turtle that we collected was well be-whiskered with green velvety filaments. So superficially did our group regard his algal adornment that he was dubbed "little mossback."

During our usual trip review, a day or two later, the little turtle was brought out of the aquarium for further examination. The compound microscope showed

that the hairy appendage wasn't moss. Finally Ward and Whipple's *Freshwater Biology* gave us a name, it must be Ulothrix, a common, unbranched, filamentous alga.

As one member of the group was looking into the microscope the wall of one cell opened a bit and a thin, green line trickled out. The tiny green particles did not just float, *they swam*. They seemed to be acting in a natural way. The text had said something about swarmspores. Were we seeing them? Then another cell opened. Confusion reigned in the laboratory. At least *one* was glad that no visitors appeared at that time. They might not have known that school was in session.

A College Botany revealed that if the swimmers from one cell numbered no more than about thirty-two they likely were swarmspores. If there were about a hundred in each cell they probably were gametes. The count was high enough that we decided they were gametes. So we were seeing gametes of these tiny organisms. These were cells of what the text had called the "sexual phase." We did not see any of the gametes actually unite but we had seen enough to imagine how they might look.

Ulothrix has no special gamete-producing parts, or gametangia, but some of the other algae we had gathered did have them. This investigation broadened our conception of these plants and for our group algae, gametes and swarmspores have a different meaning.

The after-hike discussions are the cream of the trip. We try to get all the information we can while in the field but the "suppose's" and the "what if's" of excited students when they have time to think is the valuable part of the day's activity.

For three reasons as many of these dramatic adventures as possible should be scheduled and used, for, they arouse the finest kind of student interest, they contribute information directly from its source, and they are a continual challenge to the leader to produce what he has promised.

O. W. Neher,
Manchester College,
North Manchester, Indiana.

TWO PROBLEMS OF A HYDROPHYTIC HABITAT

1. *Exploring for Male and Female Trees*

After observing and learning the parts of a complete flower, it is easy to recognize a male tree bearing only stamens and a female tree bearing only pistils. The students in searching for these specimens will have the experience of "finding for themselves." Of course the teacher will have directed them in early spring, perhaps before deciduous leaves are out, to a sandbar or the bank of creek where willow, cottonwood, or boxelder readily grows, depending on the locality.

The students will meet with these problems:

What kind of trees have we found? ———— Have we found trees with only stamens or pistils? ———— If reproductive structures such as winged fruits with seeds are present, why is it too late to find flowers? ———

If one species of tree is bearing fruits, perhaps some other will still be bearing flowers. Why are flowers not found on all trees? (The time of flowering often varies with different species. On the other hand, a particular species may not have reached sufficient maturity to bear reproductive organs, or the growing conditions may not be favorable.)

Since it is usually undesirable to have

lawn trees that reproduce freely or shed "cotton," which should be planted for ornamental purposes, trees bearing stamens or pistils? Explain why. ———

2. *Algae*

Supplies needed: Any container for carrying algae, five 250-ml. wide-mouth bottles, 5 grams of copper sulphate, a graduate cylinder, compound microscope and equipment for making temporary mounts.

A collection of algae from swift-flowing water, as rapids in a creek, has numerous advantages: the students will likely find a particular kind, *Cladophora*, which is easily identified; clean in appearance; and a good oxygenator in an aquarium. It should be scraped loose from rock to get the basal cells of attachment.

At a glance the alga is grass-green. Microscopic observation reveals cells united end to end, forming much-branched filaments. The green color is within chloroplasts.

In the laboratory prepare a stock solution of copper sulphate, 5 grams in 500-ml. of tap water, and set up each of the following in 250-ml. wide-mouth bottles:

$CuSO_4$ solution	Tap water	Parts of $CuSO_4$ to parts of water
ml.	*ml.*	
0.0	250.0	None
250.0	0.0	1:100
50.0	200.0	1:500
25.0	225.0	1:1,000
2.5	122.5	1:10,000

Place a *small* quantity of algae in each bottle, using the first one as a check.

In a few days observe with a compound microscope filaments of algae from each bottle. In what way has the color of the chloroplasts changed? ——— Have the contents of the cells been pulled away from the walls indicating that the algae are probably dead? ——— What effect does copper sulphate seem to have on algae? ——— List places where it is desirable to kill algae in your community. ———

Explain why the quantity of copper sulphate necessary to kill algae probably would not have any undesirable effects in a swimming pool, horse trough, or rain water that might otherwise have an unpleasant odor? ———

Why would this chemical not be effective in a spring where the water is moving? ———

Robert C. McCafferty,
Consolidated Schools,
Mount Sterling, Ohio.

BIOLOGY FIELD TRIPS

The author of this article has written a thesis entitled, "The Occurrence in Minnehaha County, South Dakota, of Animals Used in High School Biology Courses." This is the county in which the writer teaches. The study stated two practical ways in which the high school may benefit by using the environment in which it is located.

First, the high school may secure from its local environment practically every laboratory specimen that is needed. Locally this was found to be true, as animals from every phylum except the Echinodermata were found within the county. If specimens are secured locally the part of the budget which is usually spent for specimens may be used to purchase laboratory equipment.

Second, a practical aim of the high school biology course might be to acquaint the student with the animals and plants of his locality. Into this aim may be woven a pattern of accurate observation, collection and care of specimens, identification and mounting or display of specimens, together with an accurate labeling of each specimen. Eventually this will lead to a small museum of local plants and animals which will be of interest to incoming students and to local patrons. As the years go by newly collected specimens may be compared to those already collected, and any new specimens found may be added to those already on display. The above procedures involve use of both the scientific attitude and scientific method if carried out seriously, two factors all biology courses try to develop.

In actual practice the author and his fellow biology teachers have carried out both of the above aims. For a few years only echinoderms were purchased, together with a few single specimens of unusual animals or plants not found locally, to broaden the students concepts of the phyla, classes or orders. At present our equipment has reached a point where part of our budget may again be devoted to the purchase of laboratory specimens. Our collections include about 400 animal specimens all of which are identified as to genus and usually to the species, and about 500 plants, all mounted, identified and indexed, and kept in a steel cabinet. New display and storage cases, twenty feet in length, were installed this past winter which house the animal as well as part of the plant collections. The plant collections have been largely under the direction of the other teachers in the department who have also made studies which aid in such a project. Mr. W. D. Duncan is writing a thesis on the occurrence of flowering plants in a limited area within the county. Mr. H. I. Maggrett has made a study of drought resistant trees, during the drought period in this area, and from this study has promoted a collection of cross sections of trees. In all of these undertakings there has been student participation in the form of group or individual field trips.

The point I wish to lead up to is that biology field trips should be part of a process. With such a background as I have indicated the teacher may early in the year describe to the students the past history of the collections and museum, its present status and objectives, and possible future developments. Most students will listen with rapt attention to such recitals and the name of their friends or relatives on mounts or displays; and the possibility that their own name may appear on some of them later, has a great appeal to many students. The carrying out of such a program leads to almost endless possibilities, resolving itself sometimes into how the teacher can keep up with all that is going on or might go on with some encouragement by the teacher.

The proverbial field trip is a group going out together with their leader, to visit some given area, and with some specific object and directions in mind. We have such trips though our location in the center of a small city limits their possibilities, and extended trips are usually held on Saturday, with interested students, or with the biology club, and involve only a few students. These field trips are the backbone of the whole problem of field trips, but in this article I am more interested in what is done with the field trip material after the field trip, and in conjunction with the field trip materials.

Along this line we have students who individually bring in specimens, but

who care nothing about their later care or display. Other students do not care to bring in materials but are interested in their identification and mounting, or in their dissection or indexing. Specifically, several students during the past semester spent on an average of three hours per week relabeling, rebottling, remounting, identifying and indexing the materials which have been already collected. Three girls in particular spent nearly fifty hours after school indexing the herbarium alone.

In conclusion I do not feel that a teacher should expect every student to develop a keen interest in field trips themselves, or in the care and display of the materials later. But all students should realize that such a process is going on in their biology laboratory, and they can be shown the evidence of it, while a few can be encouraged to fit into the process and receive good training thereby. The others may find their chief interests lie elsewhere, even outside the field of biology.

H. E. Thurston,
Washington High School,
Sioux Falls, South Dakota.

THE DALLAS MEETING

Our headquarters hotel for the Dallas meeting is the Hotel Jefferson. We would like to suggest that you make your reservations early. It is a medium-priced hotel and is located close in to the center of activities of the A.A.A.S. The Representative Assembly will meet for its annual business meeting in our headquarters room at the Hotel Jefferson on Sunday, December 28. If the amount of business requires more time than that we will meet on Saturday evening, December 27, but I think that will not be necessary.

H. A. S.

FIELD TRIPS ISSUE

In organizing a practical plan for developing this issue of The American Biology Teacher on *Field Trips*, the committee making arrangements had in mind a biological trend which, year by year, looms more important as an integral part of science education; namely, Biological Field Trips. This material, therefore, is presented from two standpoints: (1) We believed the value of the work would be enhanced if a symposium of the science curriculum offered at different year levels in the school career of the student were represented in the study, *i.e.*, college; secondary; junior high school; elementary. To develop this phase of the activity, a recognized authority was invited to contribute a paper in accordance with his field of specialization. (2) Secondly, biology teachers in service were invited to contribute an article, describing an outstanding teaching experience dealing with this phase of biological science.

The special Field Trip issue of the Journal has been prepared with the view to serving both teachers who are regularly conducting field trips and, in addition, to stimulate the desire and active interest of teachers to whom this type of work is new.

Speaking for the Committee and the Editorial Staff of the Journal, I wish to state that it is most gratifying to acknowledge the unselfish assistance of the participating science teachers who were willing to crowd an additional activity into their already crowded schedule.

Lee R. Yothers, *Chairman*
Committee on Field Trips.

Back copies available at 15 cents per copy, remittance with order to Secretary-Treasurer.

President's Page

One more summer has passed and our association starts its fourth year of service. It was that idea of service that led our founders to organize *The National Association of Biology Teachers*, so let us continue in that path by each giving what he has and using the organization to his best advantage. In this give and take we will be building up both ourselves and the organization.

This past summer our individual members have engaged in a wide variety of activities. Some have traveled, some have been teaching, some have been studying in school, still others have been simply pursuing happiness to the best of their ability. Each one of us has followed his desire or need, and each in his separate direction. But even though our paths have diverged for three months, we now find them converging toward the one common goal, the education of our students in biology. Those students will be fortunate, indeed, whose teacher is just as interested in them as he is in biology, but each teacher will have his own method of showing that interest.

It is very doubtful if there is such a thing as a "best" method for teaching. If there is, it would seem that it has not, as yet, been found and agreed upon. Then it would seem that one of the purposes of our Association would be to present a multitude of ideas so that each teacher might have a wider range from which to draw. This means that each one of us must contribute our best to the Association so that we may in turn reap the best from some one else.

Those of us who are close to Chicago will have the unusual opportunity of doing this on October 11 when we have a regional meeting there. At that time we will have the opportunity of exchanging ideas with people who are prominent in the field of biology or in the field of teaching. At that time we will have the chance to meet other high school teachers who are eager to be in the "give and take" of ideas.

The same things will be true on a much wider scale on December 29 at the National meeting in Dallas. There will be teachers from all sections of the country and from all types of schools. Surely when we realize that one of our duties as teachers is to widen the horizon of our students we will not fail to take advantage of such an opportunity to widen our own. It is not alone the information we will take home, but the inspiration of meeting others and seeing what they are doing that makes these meetings worthwhile.

So it will be all through the year; if anyone has an aid for others, let us have it. If anyone is in need of aid, let us know what it is. It is only by knowing what the needs are that we will be able to continue serving our members. Our officers of the past years have done an excellent job of it, and credit for what our organization is today must be given to them. I wish especially to thank Dr. Jeffers and Mr. Houdek for their untiring efforts in maintaining the standards set for them, and Dr. Colin for giving the immense amount of time that a magazine takes. Lack of time and space prevents my mentioning the scores of others whose gifts of time and energy have helped make our organization a worthwhile one.

It is my hope that at the end of this year our organization will have prospered, grown, and served as well as it has in the past.

HOMER A. STEPHENS.

RENEW NOW PLEASE

Prevent a break in your file of the journals. Aid your officers and save the Association the expense of additional notices. Use the enclosed renewal blank.

An increasing number of our members are renewing for several years at once. If you are paid up for this year, use the enclosed blank to enroll a new member.

If you are a member of an affiliated local you may remit through your local officers, or direct.

Requests for sample copies of the journal and suggestions to the editor or officers may be written on the back of your renewal blank.

NEWLY AFFILIATED LOCALS

We are glad to announce the recent affiliation of the following local organizations with *The National Association of Biology Teachers:*

The American Society of Amateur Microscopists, under the leadership of Dr. Julian Carrington, 118 Walter Street, Chestertown, Maryland. Dr. Carrington is noted for his department "Under the Microscope" in *Nature Magazine*. If you or any of your advanced students are interested in work with microscopes you are invited to get in touch with this society.

The *Upper Sandy Valley Association of Biologists*, under the presidency of Miss Mary I. Spillman, Pikeville College, Pikeville, Kentucky.

OUR SPECIAL ISSUES

In the fall of 1940, Mr. Houdek visited me at my home. At that time he showed me the questionnaires that were sent out with the ballots in the spring of 1940. These questionnaires were to ascertain in which phases of Biology our members were most interested and if they would be willing to serve on committees dealing with the various phases. Mr. Houdek asked me to make a study of the questionnaires and report on the results at the Annual Meeting of the Executive Board in Philadelphia.

As a result of this study, I found that 36 were willing to serve on a Field Trip committee and that there was a considerable number willing to serve on other committees. After my report the Executive Board asked me to appoint chairmen of these committees and suggested that our Associate Editors might be willing to act in this capacity. Mr. Yothers was present and agreed to be chairman of the Field Trip committee. The Board hoped that we might have some special issues of the "Journal" prepared by these committees.

Mr. Yothers and his Field Trips committee are herewith presenting our first Special Issue. Other reports will follow in succeeding issues.

M. A. Russell,
President-elect N.A.B.T.

COMING IN NOVEMBER

Visual Aids Issue. Illustrated with drawings, cartoons, photographs. Helpful articles by teachers in service on Making Classroom Charts—Showcase Displays —Demonstration of Endocrine Interrelationships — Opaque Projection—Termites, etc.

NATIONAL ASSOCIATION OF BIOLOGY TEACHERS REGIONAL MEETING

Announcement

Are you a true Biologist? If so, try this. Scores of constructive school projects, the latest in conveniences in biological apparatus in commercial exhibits, leading biologists from all over the country traveling hundreds of miles to present their latest findings to you in lectures, and a dinner Lichtenwalter promises will long be remembered. All these and more at the regional meeting of *The National Association of Biology Teachers*, Saturday, October 11, 1941.

Program

9:45–10:15—Glenbard Vocal Ensemble.
Raymond N. Carr, Director Glenbard Township High School, Glen Ellyn, Illinois.

10:15–10:30—Word of Welcome.
President Homer A. Stephens

10:30–11:15—Fossils of the Carboniferous Period and Their Relation to Evolution (with slides).
Brother H. Charles, St. Mary's College, Winona, Minnesota

11:15–12:00—The Elimination of Diseases through Education.
Dr. Maud Slye, University of Chicago

1:30– 2:15—Teaching Natural History through the Medium of Conservation or Conversation.
Dr. E. Laurence Palmer, Cornell University

2:15– 2:55—The Adolescent's Sexual Development.
Dr. A. C. Kinsey, Indiana University

Banquet

6:30 P.M.—Stevens Hotel
Health and Mental Hygiene.
Dr. A. C. Ivy, Northwestern University

The National Association of Biology Teachers has established a traditional feature that you will not want to miss. It is their banquet. The association since its beginning has made this part of the program the most enjoyable, interesting, appreciated, and delightful. Each one has exceeded the other in brilliancy. The price of the banquet is $2.25, including tax and tips.

Exhibits

All teachers of Biology are invited to bring or send an exhibit of collections, projects, posters, or other teaching aids to this regional meeting. If you have an active science club, you can find no better motivation than to give the members a chance to exhibit their work before other clubs. The National Association is giving you that opportunity. All biological science clubs are invited to show their handiwork in the Stevens Hotel in Chicago, October 11. Think of it! Here is a real chance to see your own work alongside the best of its kind from other states.

There will also be an exhibit of the newer teaching aids from the biological supply companies.

Helen Trowbridge, *Chairman*
Committee on Arrangements.

HOW MANY SPECIES OF PLANTS ARE THERE?

Conservatively estimated, there are more than 335,000 species of known living plants, according to a new survey of the literature by G. Neville Jones, published in *Science* for September 5, 1941. Of this number 195,000 species are Angiosperms, 640 are Gymnosperms, 10,000 are Pteridophytes, 23,000 are Bryophyta, and 107,570 are Thallophyta. During the twenty-five year period prior to 1936 the number of new species of flowering plants discovered averaged 4,800 per year.

THE FIELD TRIP AS AN AID TO THE TEACHING OF CONSERVATION

The saying "Knowledge about a subject increases with our interest" remains equally true when the words "knowledge" and "interest" are transposed. There is no more certain way to arouse interest and to stimulate creative thought concerning the biological aspects of conservation than through the planned field trip.

Our situation here is similar to a great many other secondary schools operating on the junior-senior high school plan. Junior science is given to all students before entering what is ordinarily called the freshman year, with biology offered in the junior or senior years. In discussions with boys and girls of the twelve to fourteen year level it is interesting even though disconcerting at times, to note the false ideas and terminology built up in their minds concerning some of our very common forms of life—both plant and animal. The not unusual impression prevails that snakes as a group are harmful creatures and deserve immediate destruction. Lizards and Salamanders exist only to frighten the chance observer and that many of our harmless vines and shrubs produce poisonous effects when touched. Certainly these beliefs are not conducive to the protection and conservation of a proper balance of nature. It is gratifying to know however that the average student although somewhat gullible in his acceptance of pseudo-facts gained outside the school is willing and eager to learn the truth when properly presented to him.

In organizing a class preparatory to making a trip into the field we must take into consideration first the number in the group. It has been our experience that in general, the younger the students the smaller the group should be. A minimum of fifteen makes an excellent size group. Certainly there should not be more than thirty. Insofar as possible each student should be given some responsibility for the success of the trip. There are a number of ways in which this may be accomplished, keeping in mind that those who apparently are the least interested should be given the places of greatest responsibility. A boy who is designated to have charge of the collecting net, the aquarium jar, or the dissecting microscope may assume an entirely different attitude from the one he would take were he merely following the group. Some of the class are designated as a "safety unit." This is especially necessary if the trip lies across highways or other places of danger. Still another student can act as time-keeper to check on the passage of time and allow ample opportunity for the return to school several minutes before the end of our double period. Several students can have charge of any dissections made on the trip. These dissections should be few as we must remember we are saving not destroying.

It was indeed an excellent lesson our class learned about conservation some time ago, on an occasion when the group

Collecting Aquatic Animals

came upon a large, freshly killed bull-snake, the victim of a well-meaning farmer. Prompt dissection of the snake's stomach revealed the undigested body of a large, brown rat, caught no doubt under a near-by shock of the same farmer's wheat. Experiences of this nature linger in a student's mind indefinitely. The observation of erosion on a deforested hillside or a discussion of wind erosion due to the improper cultivation of a certain field, makes a sharper impression on young minds than an equal amount of effort to get the idea across in the schoolroom.

Our first trips in the spring deal with identification. This must be as simplified as possible. As a basis for this we use a large note-book or scrap-book titled "Notes of Field and Stream." In this we first attempt to list twenty-five or more each of the common birds, trees, insects, weeds, and shrubs of the vicinity. This must all be done from actual observation. Some of these books evolve into real sources of information and interest as notes are expanded, descriptions clarified and sketches, pictures, and mountings are added. These books are retained by many of the students, especially those who expect to further their study of biology.

The young or inexperienced teacher may at first feel a sense of failure in the achievement of the field trip. This is usually due to the fact that tangible, apparent results are not quite so evident immediately in this type of teaching as if certain other methods are followed. However, the lasting benefits outweigh any faults which may be present. Anyone who has earnestly tried the field-trip method of teaching will, I believe, agree at least in part with Louis Agassiz, the founder of the modern laboratory method, when he said, "To know nature; study nature, not books."

Hunting Fossils

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THE CITY PARK AS A LABORATORY

We who teach biology in metropolitan areas envy those of you who are in a rural situation where perhaps only a short walk from the class room is the greatest of all laboratories. The forests of native timber, with the plants and animals found in this association, the stagnant pond, the winding stream, the hedge row and the old stump are the real laboratories for nature study. Such situations are ideal for the study of biology, especially when the student comes to high school with a lifetime of "knowledge never learned of schools" and with great familiarity with the out-of-doors. These students are ready to apply the biologic principles discovered by the scientists.

The city teacher is confronted with about one hundred twenty-five students, in four classes many of whom have never visited the country. It is difficult to teach natural laws when the examples used to clarify the explanation are names which mean little to the students. The high school building may be located in the center of a great city where to

take the students on even one field trip requires bus fare, excursion permission notes from parents, all day away from other classes, and the problems of guidance service for so large a group. It is not surprising that most city biology classes have few lessons out-of-doors.

Among the objectives in offering biology in the curriculum is (1) to make the student acquainted with his environment and (2) to give him a pleasant means of recreation and satisfaction in recognizing and enjoying plants and animals in their native habitats. If these purposes are justifiable then we must put more emphasis on the out-of-doors as a laboratory for biology.

Are our city teachers making the most of our city parks as such laboratories?

The identification and recognition of trees have proved to be some of the satisfactions mentioned by students finishing the high school course. The Chicago Park district has planted many species in even small neighborhood parks. Nearly every high school is located near enough to a park that a double laboratory period would make it possible to spend at least forty or fifty minutes in actual study in the park each time an outdoor lesson is attempted. In one high school twenty-three biology classes spent from three to five double periods out-of-doors in September and found twenty-five species of trees in a three-block radius of the school. Each member of the class carried a simple identification key on the trips. Each time the class went out some one carried a killing jar and insect net for insects found on the trip and a pail and dip net for anything interesting found in a stagnant corner of the lagoon. A large magazine served as a useful container for weed specimens found in under the shrubs where the lawn mower had missed them. Since the trip was short in duration the plants were in the plant press in the class room before there was much time for them to wilt. They were identified and mounted later. These trips could even be taken the next morning after a heavy rain for many trees and shrubs grew near enough to the sidewalk to make it possible to study with dry feet and no danger of trampling wet grass. A tree walk test was interesting when a committee planned a treasure hunt and "planted" the numbers and clues in the early morning. Some classes came early on spring mornings for bird walks. Nor are spring and fall the only seasons to study out-of-doors.

The winter condition of trees can be studied at close hand on mild days. The dormant condition of the buds, the lenticels, bud scale scars, marking the season's growth of the twig, and the differences in the bark of the various species furnish material much better studied in the field than by having the twigs broken raggedly and carried into the laboratory. The elms, maples, and other trees that bloom before the spring weather arrives will be missed entirely by most indoor classes. The winter feeding stations for birds, and winter bird residents, as well as the insect cocoons, may be studied at this time.

A very good demonstration in transplanting may be observed some day when the park employees are planting a tree or when the tiny plants for summer flower beds are being transplanted. Return trips to see how the specimens have adapted themselves to the new surroundings and how man protected them by shading them or giving much water until they were established in the new places, furnish better gardening lessons than those from a printed page.

The flower shows where are exhibited

thousands of blossoms are held seasonally at the park conservatories and are excellent examples of certain units of work from the course of study. Here are demonstrated principles applying to living things.

The chrysanthemum show is a demonstration of the problems. "How has man working with nature been able to produce so many varieties from two simple ancestors?" The horticulturists who serve as guides at the Garfield Park Conservatory are trained in a vocabulary of technical terms with which the students are familiar from their textbook and class work. The guides are most cooperative in giving the class the type of lecture which will fit into the course of study quite logically. The facts sound so much more truthful when heard by the students from the lips of a professional botanist than they do coming from a mere teacher. The spring show teaches the results of bulb culture and the possibilities of arrangement in your garden. These are illustrated well in the outdoor park gardens also.

The classification and reproduction of plants can be made much more plain to the student by a tour through the conservatory with guide service in the various houses and another double period spent in the "fern room" alone where liverworts, mosses, ferns, club mosses and cycads may be compared. The guide service is excellent on this material and relieves the teacher's efforts for the details of the excursion.

With this abundance of material provided by the city and with the importance of direct contact with the specimens constantly desired by all teachers, are we passing an excellent opportunity?

Let us open a laboratory in the park!

Goldia Kinman Howes,
Flower Technical High School, Chicago, Illinois.

CHICAGO BIOLOGY ROUND TABLE

The Chicago Biology Round Table held its annual meeting at the Chicago Woman's Club on May 9, 1941.

The officers elected for the year 1941–42 are:

President: Miss Thelma F. Jones, Bowen High School

Vice President: Mr. John Coe, Lake View High School

Secretary-Treasurer: Miss Ruth Connor, Englewood High School

Corresponding Secretary: Miss Esther A. Olson, Lane High School

Mr. Ildrem Daniel of Lake View High School was appointed Editor of the Year Book.

Mrs. Eleanor Hemminger of the Illinois State Parks conducted a tour of the Illinois State Parks via colored motion pictures.

The program for the coming year is being formulated.

The Chicago Biology Round Table is assisting Miss Helen Trowbridge, recent Vice President of *The National Association of Biology Teachers*, with plans for the Regional Meeting of *The National Association of Biology Teachers* to be held at the Stevens Hotel, Chicago, Illinois, October 11, 1941. Miss Trowbridge is also a member of the Chicago Biology Round Table.

BIOLOGY TEACHERS CLUB OF SOUTHWESTERN PENNSYLVANIA

The officers of the Biology Teachers Club of Southwestern Pennsylvania for the year 1941–1942 are as follows:

President: Marie Knauz, Peabody High School, Pittsburgh

First Vice President: Walter Shively, Oliver High School, Pittsburgh

Second Vice President: W. Harold Malone, Burgettstown High School

Treasurer: Anthony Miklaucic, Imperial High School

Secretary: Marion Martin, Scott High School, North Braddock

At the September meeting in the Mellon Institute Dr. R. A. Waldron, State Teachers College, Slippery Rock, spoke on "Mexico."

Dr. O. E. Jennings, University of Pittsburgh, led the September field trip at White Sulphur Springs.

Enrollments, Teaching Loads and College Relations of Secondary School Biology: Data From a Questionnaire

H. B. GLASS
Assistant Professor of Biology, Goucher College, Baltimore, Maryland.

The training and ability of biology teachers, and the equipment and facilities provided for their teaching, have already been treated in this series of papers, based on the analysis of a questionnaire circulated among biology teachers in 1939–40. The proportionate enrollment of pupils in secondary school biology, the burden of teaching loads, and the relation of secondary school biology to college requirements are questions on which light is needed if the present status of biology teaching in the United States is to be properly evaluated. Furthermore, the extent to which the teachers and pupil-enrollments represented in returned questionnaires are truly representative of the whole country will be determined in order that all data from the questionnaire may be viewed in proper perspective. Data bearing on these questions will be analyzed in this paper.

Total Enrollment

Data for the total enrollment of the schools in which they were employed were supplied by 3,121 teachers. The total number of students thus indicated amounts to 3,096,342. The validity of this figure as a measure of the sampling made by this questionnaire depends, to be sure, on the extent to which two or more replies were received from teachers in a single school. The anonymity of the replies makes a direct estimate of such duplication impossible. Yet, because any considerable amount of duplication would seriously affect or invalidate some of the conclusions which might be drawn from the questionnaire, it has seemed necessary to form, if possible, an indirect estimate of this type of sampling error.

A check was accordingly made to determine to what extent answers had been received from two or more teachers in the same school, in Chicago and in New York City. In Chicago only 7 duplicate answers were found and in New York City only 7 more, among 57 and 96 replies, respectively. Two replies from Chicago and 4 from New York City gave no figures for total enrollments. These most probably came from schools otherwise unrepresented, so that failures to answer this question probably tend to counteract duplications. However, to be as conservative as possible, we may count them too as duplications. When this is done, the enrollment for all Chicago schools is perhaps about 12% too high and that for New York City 8% too high. Duplicates, of course, would be expected less frequently in smaller localities, especially since in Chicago, the home of the commercial company that mailed out the

questionnaires, we might expect to find a markedly higher frequency of duplicates than elsewhere. A general duplication of replies from the same school amounting to 8% therefore seems a reasonably safe assumption for the other large cities and the smaller cities. From towns and rural districts there would seem to be very little chance of securing any duplication, while 32 questionnaires in these groups failed to indicate the total enrollment for their respective schools, so that the reported enrollment here is about 11,000 too few. Taking all these factors into account, the total reported enrollment should perhaps be reduced a little over 5%, to a corrected figure of 2,934,141. In round numbers, then, high schools reported as enrolling 3,000,000 pupils have been covered by the questionnaire.

The U. S. Biennial Survey of Education for 1937–1938[1] gives the latest official figures for school enrollments that are available. For 1938 the total enrollment of all secondary schools in the nation is given as 6,673,777. The reported enrollment then represents 46.4% of the total official secondary school enrollment in 1938. This coverage may seem to be remarkably high, and further substantiation would appear desirable.

In 1935–36[2] there were 28,979 public and private (including parochial) secondary schools in the United States, in virtually all of which some biological science was taught. Their average enrollment was 206. Replies to the questionnaire therefore represent about 10% of the schools in the country, while reporting an average enrollment of 990 (see Table 2). This means that a very marked selection in favor of the largest schools prevailed in the circulation of the questionnaire.

The total number of pupils taught by 2,989 of the bioolgy teachers replying amounted to 371,962, which should be raised, by a correction for those failing to give this information, to 399,793 for the entire 3,186 teachers replying to the questionnaire. This is 6% of the students reported in the high schools in 1938 and 12.9% of the total enrollment reported by the teachers replying. If the schools reported are indeed highly selected for large size, it does not seem at all improbable that the teachers reporting would on the average teach only one-eighth of the pupils enrolled in their schools.

We may next consider the geographic character of the sample. The total enrollments reported, uncorrected for duplication, are given by states and regions in Table 1, column 2, with the respective enrollments from the U. S. Biennial Survey for 1938 in column 1, for comparison. The third column gives each reported enrollment as a percentage of the respective official enrollment in 1938. The fourth column gives the total number of pupils taught by the biology teachers reporting.

The greatest deviations from the national average percentage (46.4%) of the official 1938 enrollment are to be found in the Middle Atlantic and the Southern regions. The former is almost as much over-represented in the sample as the latter is under-represented. This is more clearly seen when the enrollments are reduced to percentages of the total enrollment reported, and compared with the official percentages of enrollment for 1938 by regions (top two rows of Table 2). New England and the West are then seen to be represented in the sample almost exactly pro-

[1] Biennial Survey of Education, 1936–1938. U. S. Dept. of Interior, Office of Education, 1941.

[2] Biennial Survey of Education, 1934–36. U. S. Dept. of Interior, Office of Education Bulletin 1937, No. 2, Vol. II, 1939.

TABLE 1

Enrollments in the schools reported

	U. S. Biennial Survey 1937–38	Enrollment covered by questionnaire	Per cent of official enrollment sampled	Total pupils taught by biology teachers reporting
Connecticut	93,966	46,952	50.0	3,958
Maine	45,089	4,732	10.5	1,289
Massachusetts	257,497	118,813	46.2	12,556
New Hampshire	27,007	12,968	48.0	1,837
Rhode Island	35,373	14,218	40.2	1,699
Vermont	16,214	1,656	10.2	869
New England	475,146	199,339	41.9	22,208
Delaware	13,228	3,561	26.9	298
District of Columbia	27,778	29,038	104.8	1,676
Maryland	71,338	18,578	26.0	4,189
New Jersey	221,701	113,758	51.3	10,624
New York	770,770	640,221	83.1	33,379
Pennsylvania	544,543	255,339	46.8	36,128
Virginia	119,401	27,481	23.0	6,158
West Virginia	85,888	49,022	57.1	9,035
Middle Atlantic	1,854,647	1,136,998	61.2	101,487
Illinois	381,509	409,951	107.5	33,182
Indiana	192,871	99,126	51.4	14,267
Iowa	149,040	32,523	21.8	7,215
Kansas	111,704	45,088	40.4	7,995
Kentucky	99,798	17,115	17.1	3,347
Michigan	261,340	134,226	51.4	15,900
Minnesota	148,732	63,132	42.4	13,410
Missouri	171,546	68,402	39.9	9,006
Nebraska	85,030	19,604	23.1	4,907
North Dakota	36,674	4,787	13.1	2,266
Ohio	372,726	198,271	53.2	28,951
South Dakota	39,063	13,489	34.5	2,850
Wisconsin	184,835	103,237	55.8	16,091
Central	2,234,868	1,208,951	54.1	159,387
Alabama	92,276	37,420	39.5	6,077
Arkansas	67,028	2,983	4.5	1,492
Florida	74,760	10,136	13.6	1,948
Georgia	114,761	9,734	8.5	1,641
Louisiana	97,109	9,051	9.3	1,476
Mississippi	70,255	2,916	4.2	1,101
North Carolina	183,556	25,468	13.9	8,322
Oklahoma	135,081	34,270	25.4	9,291
South Carolina	78,242	5,620	7.2	1,180
Tennessee	102,475	9,271	9.1	2,680
Texas	329,494	48,340	14.7	8,319
Southern	1,345,037	195,209	14.5	43,527
Arizona	21,127	11,054	52.3	1,318
California	359,257	227,518	63.3	20,882
Colorado	57,990	22,324	38.5	3,788
Idaho	33,386	10,135	30.4	2,521
Montana	33,524	8,822	26.3	2,219
Nevada	5,286	730	13.8	197
New Mexico	22,001	4,130	18.8	1,161
Oregon	62,968	16,829	26.8	3,518
Utah	42,594	7,820	18.4	1,888
Washington	110,311	43,667	39.6	6,733
Wyoming	15,635	2,814	18.0	1,128
Western	764,079	355,845	46.6	45,353
Total U. S.	6,673,777	3,096,342	46.4	371,962

portionately to their official enrollments. The Central states are somewhat over-represented (+6.5%), the Middle Atlantic states more (+8.9%), and the

TABLE 2

Percentages of the total secondary school enrollment reported, grouped by geographical regions and by size of community

	Entire U. S.	New England	Middle Atlantic	Central	South	West
Distribution of pupils in:						
U. S. Biennial Survey, 1938		7.1	27.8	33.5	20.2	11.4
Present questionnaire		6.4	36.7	39.0	6.3	11.5
Large cities	52.6	2.4	24.4	19.0	2.1	4.7
Small cities	27.2	3.0	6.0	12.2	1.9	4.2
Towns	11.7	0.5	4.1	4.0	1.3	1.7
Rural	5.6	0.2	1.0	2.7	0.9	0.8
Private-parochial	2.8	0.3	1.1	1.1	0.1	0.1

Southern states are under-represented by an amount (−13.9%) virtually equal to the combined over-representation elsewhere.

In isolated instances, such as that of Washington, D. C., recent rapid growth in population may be reflected in the fact that the enrollment sampled by the questionnaire is larger (104.8%) than the official enrollment for 1937–38. The excessive enrollment found for Illinois (107.5%), on the other hand, is no doubt due to the fact that a large proportion of the questionnaires was mailed out from Chicago by a commercial company. It would be expected that their mailing list would be most complete in home territory, and that a higher percentage of answers from more than one teacher per school would result. It should be kept in mind that the total enrollments reported in Table 1 are not corrected for duplications.

The enrollments were next grouped according to the size of the community in which the reported school was located. In the category of "large cities" are included all those over 100,000 in population.[3] "Small cities" are those from 10,000 to 99,999 in population, "towns" range from 2,000 to 9,999, and all communities below 2,000 are classed as "rural." Table 2 gives the percentages of the total reported enrollment falling into each class. It is evident that city schools have furnished the great bulk (over three-fourths) of the total enrollment reported. The U. S. Biennial Survey of Education for 1934–36 groups enrollments into "urban" and "rural" only, with the latter category including all communities of less than 2,500 in population. The Survey reports 3,575,360 "urban" and 2,399,177 "rural" pupils, or 59.8% urban and 40.2% rural. Clearly, then, the questionnaire has sampled the rural high school population very poorly, and all conclusions dealing with conditions in this group of schools should be accepted with the reserve imposed by the fact that replies from only 1,009 such (public) schools are available and that these schools have the lowest enrollment. The ratio of enrollments representing the smaller communities (towns and rural) to that of the larger ones (cities) varies considerably from region to region. It is about one-half in the South, one-fourth in the West, one-fifth in the Central states, one-sixth in the Middle Atlantic region, and is lowest (one-eighth) in New England. Probably no

[3] Elsewhere nine selected large cities (New York, Chicago, Philadelphia, Detroit, St. Louis, Washington, Seattle, Minneapolis, and Milwaukee) have been tabulated separately, but in all cases they are also included in the group of "large cities."

conclusions with respect to New England rural schools should be regarded as valid without further substantiation.

Table 3 presents the average sizes of the enrollments reported in various categories.

The general picture presented above is further confirmed by these data. The average enrollment reported is approximately five times as great as the average enrollment (206) of all U. S. high schools in 1936. Only in the South and in private and parochial schools (except in the latter in the Middle Atlantic area) does it fall significantly below the general average of reported schools. In New England, and even more so in the Middle Atlantic region, the public schools reported average much larger than the group from the nation as a whole. When size of community is considered, it is apparent that even in large cities there must have been a selection in favor of the largest schools, for an average enrollment of over 3,000 is reported in this class. To a lesser extent the same selection appears to have prevailed in smaller cities, towns, and rural areas. Two major factors probably account for this distortion of the sample. Because a commercial mailing list and the N.A.B.T. membership list were used in circulating the questionnaire, the larger schools, with substantial budgets, were more likely to receive the questionnaire. Secondly, the larger the school, the greater must be its staff of teachers in biological science, and consequently the greater the probability that some one of them would have made a return. This type of distortion is probably unavoidable without a tremendously greater expenditure of time and money in the circulation of the questionnaire than was possible. The fact remains that the scholastic population sampled is highly urban, and also fails adequately to represent the schools of the South. The picture of biology teaching in the United States drawn from the analysis of these returns is therefore based predominantly on the larger, better financed and better staffed high schools, and may be regarded as the brightest picture possible. To what extent it would be changed with a more representative sample is a matter of conjecture.

Average Size of Biology Classes and Teaching Load

Replies from 3,117 teachers yield a nation-wide average of 28.2 pupils per

Table 3

Average enrollments in the secondary schools reported

U. S.	No. of replies 3121			Av. enrollment 993.6		
	Public		Parochial		Private	
	No. of replies	Average enrollment	No. of replies	Average enrollment	No. of replies	Average enrollment
New England	154	1230.4	1	67.0	42	263.9
Middle Atlantic	652	1689.5	25	966.7	48	205.5
Central	1326	885.6	54	311.2	62	277.0
Southern	352	543.3	7	272.6	11	111.6
Western	361	968.9	8	93.7	16	151.6
Special large cities	(240)*	4111.9				
Large cities	542	3009.5				
Small cities	565	1491.5				
Towns	744	486.6				
Rural	994	175.8				

* Also included in "large cities."

biology class. Public schools separately average 28.8, parochial schools 27.9, while private schools appear to have considerably smaller-sized classes, averaging only 18.0 Table 4 gives the average

TABLE 4

Average size of biology classes

New England	29.1
Middle Atlantic	32.1
Central	27.6
Southern	27.9
Western	27.6
Special large cities	35.9
Total large cities	34.1
Small cities	31.1
Towns	29.4
Rural	24.0

size of biology classes by geographical areas and in communities grouped according to size.

It is evident that there are no outstanding differences in class size from region to region. The Middle Atlantic region has the highest average class size, the Western states the lowest. The average size, however, in all regions is considerably above that generally regarded as optimum.

In New Jersey, to take an example, the average class size for public schools (79 replies) is 30.8. This is somewhat larger than the average class size found in 1931 in this same state by Reed,[4] who reported average classes of 29.52 in general science and 25.96 in biology. However, he had a broader representation of the state as a whole, and he probably had relatively more returns from rural and small town schools, which would have had smaller classes. Our tabulation shows that 23.5% of all classes in biology and general science reported from New Jersey's large cities now have 35–39 pupils. There are only 4.8% of the classes from small cities with so many. Reed found that one-fourth of the general science classes in New Jersey had more than 33 pupils, and one-fourth of the biology classes had more than 30. Evidently in this state crowding in science classes has altered but little in the eight intervening years.

Among the private schools of different regions there is little variability in average class size. Among parochial schools the only very significant departure from the general average of the group is to be found in the Middle Atlantic states, where 25 replies average 38.7 pupils per class. This is even higher than the average class size in the public schools of this region.

The tabulation also makes it quite clear that crowding varies directly with size of community, being worst in the great cities. Class size is nearest the optimum in rural areas, but even there one-half the classes are above the optimum for effective laboratory and field work.

The frequency of crowding is strikingly revealed by another type of computation, summarized in Table 5, giving the percentages of city teachers who report the average size of their classes in biological science as being above 35. 50.6% of "large city" classes throughout the nation have classes of 35 or more, and 26.5% of those in smaller cities are similarly crowded. Can laboratory or field work possibly be effectively directed by a single teacher in classes of this size? All too probably the result must be to fall back on demonstrations and lectures, without offering the student any opportunity to make a first hand acquaintance with living organisms or to become familiar with the experimental methods of the scientist. Surely this stultifies the generally ac-

[4] Reed, Rufus D. 1932. Range of Subjects Taught, Teaching Load, and Preparation in Science of the Science Teachers of New Jersey. *Jour. Chem. Educ.*, 9: 326–343.

TABLE 5

Percentage of teachers reporting the average size of their classes as 35 or more pupils. Classes in general science and biology only (physiology, hygiene, senior science omitted), in the public schools of large and small cities

Region	Size of cities	Number teachers reporting	50 + pupils	40–49 pupils	35–39 pupils
			%	%	%
New England	Large	32	0	3.1	21.8
	Small	58	0	1.8	31.2
Middle Atlantic	Large	185	1.8	34.0	42.1
	Small	123	0	10.5	21.9
Southern	Large	37	0	8.1	10.8
	Small	59	0	11.8	15.5
Central	Large	227	0	6.6	37.9
	Small	250	0	1.6	22.9
Western	Large	69	0	0.0	27.6
	Small	72	0	1.4	16.7
Total, U. S.	Large	*550*	*.0036*	*14.9*	*34.9*
	Small	*562*	0	*4.6*	*22.0*

Total "large city" classes of 35 or over = 50.6%
Total "small city" classes of 35 or over = 26.5%

cepted aims of biology teachers for the future citizen!

Data on the average number of students taught by the biology teachers replying to the questionnaire are presented in Table 6.

TABLE 6

The total number of students per biology teacher, and the relative percentage of those students taking biology

	Number of students	Per cent taking biology
U. S.	124.4	65.0
Public schools	128.2	66.2
Parochial "	117.2	48.4
Private "	68.4	57.0
Public schools only		
Large cities	158.5	85.7
Small cities	145.5	85.5
Towns	133.9	58.8
Rural	98.5	41.3
New England	133.3	72.8
Middle Atlantic	152.6	68.7
Central	118.4	65.0
Southern	120.9	58.3
Western	125.5	70.0

The average pupil load for the biology teachers of the nation as a whole is 124.4, with approximately two-thirds of those pupils taking biology. One-third of the average biology teacher's pupils are then in other fields, circumscribing the time and effort which the biology teacher is free to devote to his main line of work. This is even truer of the average biology teacher in parochial schools, only half of whose energy can be directed to biology students, while the teaching load is practically the equivalent of that in the public schools. Biology teachers in private schools average only slightly more than half the pupil load of their fellows in public and parochial schools, and at the same time have a greater proportion of their students in biological courses than do teachers in parochial schools.

When the extensive data on the public schools are broken up for analysis, it is at once evident that the pupil load varies directly and considerably with the size of the community in which the school is located. The average biology teacher in a city of over 100,000 popula-

tion must teach 60% more students than the average biology teacher in a rural school. This is only partially compensated by a higher degree of concentration on biology on the part of the teacher in city schools. It is worth while noting at this point, that there is no difference in the teacher's proportion of biology students (86%) in schools located in large cities and small cities, although the teacher in the latter location has on the average a smaller total load.

In town and rural schools, of course, the teacher's proportion of biology students drops sharply. Only in the city schools is it at all true that the teacher of biology is a teacher of biology alone.

TABLE 7

Degree of interference by extracurricular or supervisory duties with biology teaching, in percentages of replies

	Slight	Much	Very serious
	Per cent	Per cent	Per cent
All schools	64.0	24.5	11.5
All public schools	63.4	24.9	11.7
Special large cities	61.8	25.2	13.0
Large cities	68.3	21.9	9.9
Small cities	71.3	20.2	8.5
Towns	63.5	25.6	10.9
Rural	56.3	28.5	14.8
New England	65.3	28.3	6.4
Middle Atlantic	66.6	22.7	10.5
Central	60.2	26.3	13.5
Southern	69.5	21.1	9.4
Western	67.6	22.1	10.3

Considered geographically, only two figures seem sufficiently divergent from the national mean to deserve comment. The first is the very high total pupil load per teacher in the Middle Atlantic states (152.6), which equals that found generally only in the schools of our largest cities. In the parochial schools of this region, not listed in Table 6, the load reaches the record high, an average of 169 pupils per teacher. The second item worthy of comment is the difference of 15% between the proportion of biology students falling to the lot of a New England biology teacher, on the one hand, and a biology teacher in the South, on the other.

Private schools of the Central states have the highest teacher-pupil load (86.1) in their category; those in the Southern and Western states have the lowest (50.5 and 52.7 respectively). For the relative proportion of biology students in the total pupil load, there are no very great deviations from the national average within this group of schools. It is consistently low.

Interference with Teaching by Extracurricular and Supervisory Duties

Another item of the questionnaire was framed to inquire whether supervisory or extracurricular duties interfere at all frequently with biology teaching. Teachers were asked to check either "only slightly," "much," or "very seriously" in response to this question. Table 7 gives the results in percentages, 2,937 teachers responding. It seems that about one-third of all biology teachers feel they are hampered to a considerable degree in their teaching by other duties, and about one-tenth very seriously so. The replies, sorted according to geographical regions and size of community, still show a striking degree of uniformity. The difference between the regions reporting the highest and lowest frequencies of interference (Central and Southern, respectively) amounts to only 9.3%. Teachers in small cities seem to have least interference with their teaching by other duties, with this burden increasing both in larger cities and in towns, and becoming greatest in the largest cities and in the

rural areas. However, the maximum difference, that between teachers in small cities and in rural schools, is only 14.8%, and the difference for those reporting very serious interference is only 6.3%. Approximately the same general percentage of teachers in parochial and private schools (31.2 and 29.2%, respectively) also feel hampered in their biology teaching by extra duties. Considering the subjectivity of responses to this item, these differences may not be significant. It is more important to keep in mind how uniformly the replies indicate that one-third of all biology teachers feel they are subject to serious interference with their teaching because of other duties.

Number of Graduates Entering Colleges or Special Schools

The replies to this item of the questionnaire are given in Table 8.

Table 8

Percentages of graduates entering colleges or special schools

	All	Public	Parochial	Private
	Per cent	Per cent	Per cent	Per cent
U. S.	*25.4*	22.5	31.3	68.2
New England		20.0	(16.0)*	80.3
Mid. Atlantic		21.8	31.3	71.4
Central		20.4	27.9	56.2
Southern		27.7	44.4	68.1
Western		27.4	34.6	66.8
Large cities		27.6		
Small cities		27.8		
Towns		21.7		
Rural		18.3		

* Only 1 reply.

Students from cities, whether large or small, evidently continue with higher education more frequently than those from town and rural schools, in decreasing order. Parochial schools send on about 10% more than public schools, on the average, and private schools far surpass those of either other category in this respect, with over two-thirds of their graduates going on to colleges or special schools. Considered geographically, the public schools of the Southern and Western states send on to higher schools a considerably greater percentage of their students than do those in other regions, the general rate from the South and West ranking with that from city schools over the nation as a whole. Further evidence is to be seen from a list of those states deviating by more than $\pm$ 7.5% from the national average. Only Vermont (9.7%—7 replies) falls below 15.0%. Above 30.0% are Colorado (30.3%—27 replies), North Dakota (30.3%—25 replies), Oklahoma (30.6%—71 replies), California (30.9%—127 replies), Idaho (31.7%—18 replies), Utah (32.1%—7 replies), Mississippi (32.9%—10 replies), Texas (33.4%—67 replies), Arizona (34.1%—8 replies) and Louisiana (36.6%—9 replies). Nor is it true that where the number of replies is small they are mainly from city schools; on the contrary, almost half are from rural schools. No doubt these figures may occasion some surprise.

Effect of College Entrance Requirements on the Amount of Biology Taught in Secondary Schools

Teachers were asked to give their opinion as to whether college entrance requirements tend to increase, decrease, or not to affect seriously either the number of courses of biological science offered in their schools or the number of pupils enrolling for them. Table 9 summarizes the result of their replies, 2,910 in number.

There is a high degree of variability in opinions as to the effect of college entrance requirements. In general, about three-fourths of all biology teachers ap-

TABLE 9

The effect of college entrance requirements on the amount of biology in secondary schools, in percentage of replies

	Increase	No effect	Decrease
	Per cent	Per cent	Per cent
All schools	21.2	73.0	5.8
Public	20.4	73.8	5.8
Parochial	29.3	59.8	10.9
Private	30.0	66.9	3.1
Special large cities	6.4	72.5	21.1
Large cities	18.0	67.1	14.9
Small cities	25.2	67.5	7.3
Towns	18.6	77.9	3.5
Rural	20.1	77.7	2.2
New England	25.1	71.8	3.1
Middle Atlantic	16.9	74.0	9.1
Central	20.0	75.6	4.4
Southern	27.8	70.5	1.7
Western	22.1	67.0	10.9

pear to regard them as having little or no effect. There is also a generally higher percentage of opinion holding that college entrance requirements tend to increase the amount of biology given rather than to decrease it. Only in the nine selected large cities is the situation almost exactly the reverse, where over one-fifth of those replying report a tendency on the part of college entrance requirements to decrease the amount of biology given.

SUMMARY

1. The questionnaire under analysis has polled biology teachers teaching 6.0% of the secondary school pupils in the nation, in schools enrolling at least 40.0%.

2. The sampling of the secondary school student population has been relatively concentrated in cities above 10,000 in population, and has been low in rural areas. It has also been low in the Southern states.

3. The average size of the biology class varies directly with community size. In cities of over 100,000, 50.6% of the classes include more than 35 pupils.

4. The average number of pupils per biology teacher is 124.4, 65.0% of whom are students in one of the biological sciences. The teaching load, in biology, is 60.0% higher in large cities than in rural areas, and is significantly greater in the Middle Atlantic region than elsewhere. The percentage of biology students among total students taught by biology teachers is highest in city schools, lowest in rural and parochial schools.

5. About one-third of all biology teachers feel themselves considerably hampered in teaching biology, because of extracurricular or supervisory duties.

6. The average number of graduates who enter college or special schools from the secondary schools reported is 25.4%. The proportion varies directly with size of community, is highest in the Southern and Western regions, and rises to about two-thirds in private schools.

7. About one teacher in five regards college entrance requirements as tending to increase the amount of biology in their secondary schools. About one in twenty thinks the effect is the reverse.

Biological Briefs

Cox, W. T. *The Fight for the Woodland Caribou.* American Forests 47: 54–57; 93–94. February, 1941.

The woodland caribou, once abundant in the open bog country of Minnesota, have until very recently been in serious danger of extinction. Inroads by hunters were largely responsible, but another factor has been the drainage of swamps and subsequent fires in the peat beds

thus exposed. The drainage ditches proved traps for the animals, and where formerly calves were dropped safely on islands, they were made liable to the attacks of wolves. In 1932, the Red Lake State Wildlife Refuge of Minnesota was established and a 450,000 acre tract fenced in. The few settlers were moved out and the district patrolled for fires and poaching. In 1937, a breeding stock of 9 animals was introduced from Saskatchewan, Canada, since only three native individuals were found on the preserve at that time. The herd is now slowly increasing.

PETERSON, ROGER T. *Bird Migration.* Audubon Magazine (formerly Bird-Lore) 43: 49–58. January–February, 1941.

Many claim that there is no spot of earth over which some migrant birds do not fly. There are 7 main flyways over North America which many species follow, however. The greatest advantage of migration is the assurance of a year-round food supply. Theories differ as to its origin in evolutionary history; some believe that the habit was established in following the edges of the great polar ice cap as it advanced and retreated with the seasons; others suggest that population pressure during the nesting season may have been the original cause. The immediate control over migration is exercised by the endocrine glands as they are affected by the lengthening or shortening days. How bird travel is guided is unknown, since in rare cases only do young birds follow their parents. They follow major topographic features to some extent, but much of their journey is accomplished by "blind flying" The Arctic Tern and Golden Plover are long-distance champions, although even the Ruby-throated Hummer flies from the St. Lawrence to the tropics across the Gulf of Mexico. These birds average 50 miles per hour, while most small birds fly 20 to 30 miles per hour for a night and then rest for several days before continuing. Most birds travel within a half-mile of the earth's surface. Greatest dangers are from strong winds and sudden low temperatures. Returns have been obtained from one in every 15 birds banded. At present, very few bird-banding permits are being issued by the Fish and Wildlife Service of the Department of the Interior, because the present facilities for handling the reports from banders now active are overtaxed.

HARRIS, HAROLD J. *The Raw Milk Menace.* Hygeia 19: 208–210; 234; 250. March, 1941.

In recent years, "Malta Fever" has attracted attention as a disease little known and difficult to understand. The germ was first isolated by Sir David Bruce in 1886; hence the name "brucellosis." Goats, cattle, pigs, horses, sheep, and man are subject to it. A sample group testing seems to indicate that 10% of our population and 20% of American cattle are now infected. It cannot be transmitted from one person to another, but may be contracted by drinking infected raw milk or by handling infected animals or meat. Like syphilis, the disease is a great masquerader, and there is no typical set of symptoms or mode of onset. It usually begins like the "flu," with chills, backache, headache, sore throat, and sweating. It may appear similar to inflammatory rheumatism, typhoid fever, or as a cause of miscarriages. It may greatly increase the seriousness of coexisting diseases. Prevention is mainly by drinking only pasteurized milk; treatment, by vaccine. Blood and skin tests are used for diagnosis.

RUTH SHERMAN STEIN

Books

Biology of the Laboratory Mouse. By The Staff of the Roscoe B. Jackson Memorial Laboratory, George D. Snell, Editor. The Blakiston Company, Philadelphia. ix + 497 pp. 172 figs. 1941. $7.00.

This book is a unique contribution to the biology of one of the most widely used of the laboratory mammals. The chief purpose behind its publication is to make accessible to investigators the scattered data on the mouse. The authors hold that great progress will result from such a synthesis of the specialized techniques which have been applied to the study of one animal. It is more than a mere compilation, however: during its preparation gaps found in the literature were filled in by special research projects.

As the product of an institution famous for its researches on cancer, *Biology of the Laboratory Mouse* is especially rich in material on the problem of tumor formation. There is much in it to appeal to the embryologist, the histologist, the pathologist, and the geneticist. Teachers and students of mammals in general will find it very interesting and useful.

Some idea of the variety of information contained in the book may be had from the chapter headings: The Early Embryology of the Mouse—George D. Snell; Reproduction—George D. Snell; Histology—Elizabeth Fekete; Spontaneous Neoplasms in Mice—Arthur M. Cloudman; Gene and Chromosome Mutations—George D. Snell; The Genetics of Spontaneous Tumor Formation—C. C. Little; The Genetics of Tumor Transplantation—C. C. Little; Endocrine Secretion and Tumor Formation—George W. Woolley; The Milk Influence in Tumor Formation—John J. Bittner; Inbred and Hybrid Animals and Their Value in Research—W. Lawson Russell; Parasites—Walter E. Heston; Infectious Diseases of Mice—John H. Dingle; Care and Recording—John J. Bittner.

This volume is very well organized and clearly and interestingly written. It is abundantly illustrated with excellent drawings and halftones. The illustrations are made all the more effective by the complete labeling on the cuts and the designation of the scale of magnification of each figure. Extensive bibliographies are placed at the ends of the chapters. There is a complete index. Typography, make-up, paper, and binding are all of excellent grade. The book is recommended as a valuable addition to the biology library.

E. C. C.

Guyer, Michael F. *Animal Biology.* 3rd edition. Harper & Brothers, New York. xix + 723 pp. 1941. $3.75.

Guyer, in his book "*Animal Biology*," has accomplished an excellent piece of work through his logical, interesting, and original organization. An appeal and curiosity for digesting this text grips one as soon as one opens it. On further acquaintance with the context one appreciates even more the worthwhileness of such a valuable source book.

The author, in his third edition, has made some excellent additions which have improved this book very materially. The complete new chapter on ecology provides the student with a concise review of the field, and constitutes one of the most valuable as well as available summaries. Interesting recent new work has been reviewed, for example: "mating types" in paramoecium; the section on birds rewritten; the classification of mammals reorganized; and numerous new illustrations added.

The new "*Animal Biology*" adheres to the general principles underlying the usual types course stressing the fundamental concepts of all life phenomena with constant application to human structures, functions, and problems. Its contents are recent, accurate, scientific; and yet, written in a fascinating, colorful style to hold the interest of the student.

This is an especially inspirational text for the instructor in that it will assist him in presenting materials to the student in such a way as to arouse in the individual a lasting, intellectual curiosity to want to know more about himself and the world about him.

Guyer's "*Animal Biology*" should be owned and used by every biology teacher.

Helen Trowbridge,
Glenbard Township High School,
Glen Ellyn, Illinois.

Skilling, William T. *Tours Through the World of Science: A General Science Text Book.* Revised edition. McGraw-Hill Book Company, New York. xiv + 815 pp. 1941. $1.70.

This book is a revised edition of the one copyrighted in 1933 and in 1934. It has 815 pages, 749 devoted to the text and the rest to guides, glossary, and index. The textual material is complete and contains many items of interest not found in the older General Science text-books. For example, the amount of curvature of a water surface, the cyclotron, wire photo, and the telescope on Palomar Mountain are discussed. The arrangement is unique and would appeal to the interest and

imagination of the pupil, as it is divided into 19 Tours. Quoting from the "Note to Teachers" in the front of the book, "The fiction of travel is maintained throughout the book, by means of the title, the paragraph headings treated as road signs, and the imaginative introduction to each tour." Six Tours, 268 pages, are devoted to Physical Geography, seven Tours, 280 pages, to Physics, one Tour of 39 pages to Chemistry, and five Tours, 200 pages, to Biology. At the end of each Tour is a series of topics for discussion. Each tour also contains several experiments and thought questions. The book is well bound, easy to read, printed on good quality paper, and has clear well labeled illustrations.

A criticism of the book would be that the Glossary leaves out many words that the student would like to look up. Also the index is not as complete as is desirable in a reference book. I feel that the mathematics of the book is too difficult for most Junior High pupils to use as a text, but it would be a useful book to have on the reference shelf. For a school having a year of Senior Science I think it would be a valuable book.

M. A. Russell.

Cockefair, Edgar A., and Cockefair, Ada M. *Health and Achievement*. Ginn and Company, New York. 558 pp. 1940. $1.26 (school price).

There are many new types of high school biology texts being released. Most secondary school biology books include topics on diet, health, physiology, taxonomy and heredity. Many of the textbook writers are taking different sections and elaborating some into detailed texts. This is as it should be; more facts, more newspaper articles, the raising of educational levels throughout all grade of schooling make such a specialization necessary. *Health and Achievement* elaborates the hygiene of physiological function. There are ten units taking up some of the following problems: The problem of Improvement in Life—Our Protective Tissues—the skin and its glands. The problem of How the Body Cares for its Needs—circulation, function and hygiene. The problem of Where Life Gets its Energy—food and diet. The problem of Ill Health and Accidents, and their Causes, and How Life Continues Itself. This might conceivably be a reference text as well as a regular class room book.

The book is a 5½ × 8-inch green-covered fairly pleasingly designed text. The topography is well spaced, readable and clear. The halftones require more selection, more consideration of artistic merit and composition. Material is arranged in problem form. There is an overview to each unit. Appended to the book there is a bibliography with an unusual emphasis on references in *Hygeia* and *Popular Science* magazines in addition to a modicum of popular readings. A glossary is elaborated.

Alan A. Nathans.

Forbes, James. *A Laboratory Manual for Histology*. Fordham University Press, New York. v + 74 pp. 1941. $1.25.

This manual briefly correlates histology with anatomy and physiology. A short introductory explanation is devoted to microscopy and drawing. Each variety of tissue is concisely treated. Basic requirements for student drawings are included. Appropriate and significant questions may be found at the conclusion of many exercises. In the bibliography of over 40 titles are many standard references; the citations omit dates and designation of edition. Attention to technique is scant and refers to blood smears and temporary mounts. An accompanying text is needed.

James M. Sanders,
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FISCHER, HELEN F., and HARSHBARGER, GRETCHEN, F. *The Flower Family Album.* University of Minnesota Press, Minneapolis. 130 pp. 1941. $2.50.

Excellent line drawings of almost five hundred flowers, weeds, vegetables, and house plants. Arranged in family groups. In most cases it is one family to a page. Both common and scientific names are given.

The text contains may garden suggestions and some folk-lore items in addition to accurate scientific descriptions and comparisons.

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P. K. HOUDEK.

STEINHAUS, ARTHUR H., and GRUNDERMAN, FLORENCE M. *Tobacco and Health: Some Facts about Smoking.* Second edition. Association Press, New York. 48 pp. 1941. Paper, 35 cents.

A simply written, non-technical survey of the literature on the effect of tobacco on human beings. There are 13 short chapters dealing with such topics as the effect of nicotine on hunger and stomach activity, ulcers and smoking, heart rate and blood pressure, smoking and athletics, smoking and longevity, the use of tobacco by pregnant women, and tobacco and cancer. The statements are largely factual, with citations of authorities.

WATTS, MARY T. *Tree Finder.* Nature Study Guild, Ravinia, Ill. 38 pp. 1939.

A small-sized, paper-covered pocket manual for the identification of trees by their leaves. Using drawings and brief descriptions, the trees are identified as to common names.

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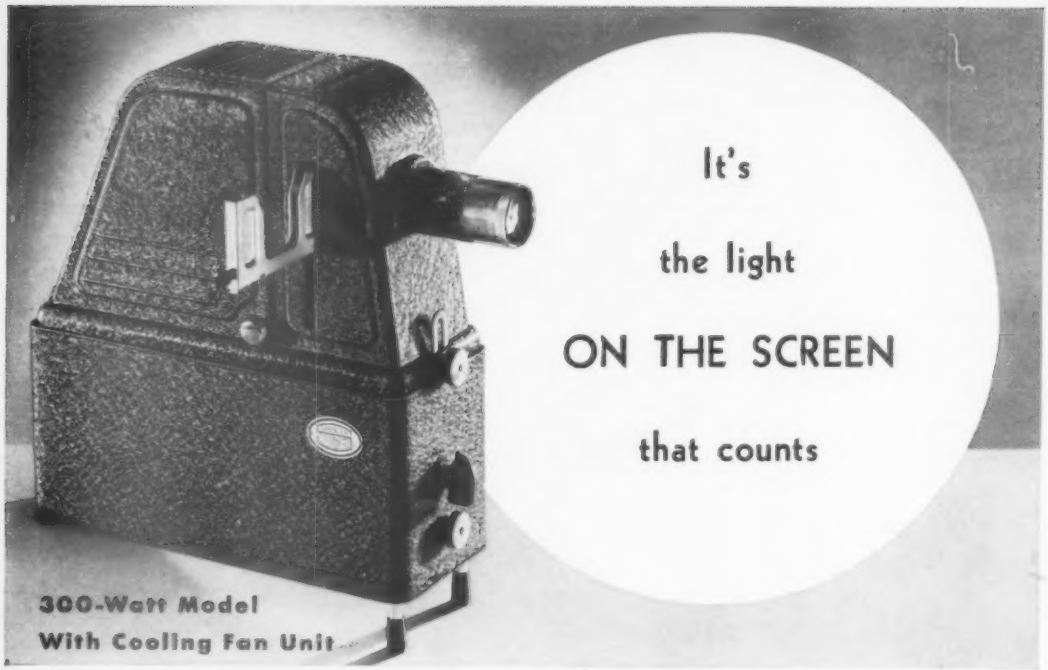

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